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10/628,316	07/28/2003	Jeanette E. O'Hara	GMC 0048 PA/40360.53/GP-3	4452

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EXAMINER	
LEE, CYNTHIA K	

ART UNIT	PAPER NUMBER
1745	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/628,316	Applicant(s) O'HARA, JEANETTE E.
	Examiner Cynthia Lee	Art Unit 1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 28 July 2003.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-46 is/are pending in the application.

4a) Of the above claim(s) 46 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-45 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 28 July 2003 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 10/15/03, 11/8/04.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-45, drawn to an energy generating device, classified in class 429, subclass 41.

II. Claim 46, drawn to a method of fabricating a diffusion media, classified in class 260, subclass 1.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different designs, modes of operation, and effects (MPEP § 802.01 and § 806.06). In the instant case, the different inventions have different effects. Invention I generates energy and Invention II is a method of making a diffusion media.

Because these inventions are independent or distinct for the reasons given above and have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are independent or distinct for the reasons given above and the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.

Because these inventions are independent or distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

During a telephone conversation with Mr. Jim Beyer on 4/17/2006 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-45. Affirmation of this election must be made by applicant in replying to this Office action. Claim 46 is withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Information Disclosure Statement

The Information Disclosure Statement (IDS) filed 10/15/2003 and 11/8/2004 have been placed in the application file and the information referred to therein has been considered.

Drawings

The drawings received 7/28/2003 are acceptable for examination purposes.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 25 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The limitation "structure defining a vehicle powered by said fuel cell" does not further limit "a device configured to convert a hydrogenous fuel source to electrical energy" as recited in claim 1. Correction is required.

Claims Analysis

As to the method limitations of the controller as recited in claims 1, 20-23, 26, 27, 36, they do not further limit or give breath and meaningful scope to the product claim. Hence, these limitations have been considered, but were not given patentable weight.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 5, 9-11, 15, 17-25, 27-30, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton (US 2003/0157397), as evidenced by Yoshida (US 2003/0091891).

Barton discloses a fuel cell comprising a cathode gas and an anode gas. The fuel cell comprises a gas diffusion backing layer on a catalyst coated membrane. The reactant gases traverse through the gas diffusion backing layer, and thus are humidified. The gas diffusion backing comprises a porous carbonaceous paper having randomly oriented fibrils (applicant's claim 15). The gas diffusion backing further comprises a microporous layer adjacent the porous carbonaceous paper. The microporous layer consists essentially of a fluorinated polymer that contains carbon particles [0050, 0055]. The carbon particles can comprise graphite fibers [0069]. The fluorinated polymer comprises poly(vinylidene fluoride) and PTFE [0060] (applicant's claim 9). Carbon particles can be of any form that include, but not limited to Vulcan ® XC72, SP Carbon & Ensaco, and Applied Science Graphite Fibers (applicant's claim 3)

with an average surface area of about 50 to 800 m2/g [0069] (applicant's claims 1, 2, 5, 27, 28).

Although Barton discloses an average surface area of about 50 to 800 m2/g [0069] (applicant's claims 1, 2, 27, 28), Barton does not disclose that the surface area is below about 85 m2/g, between 60 m2/g and 80 m2/g, between 200 m2/g and 300 m2/g, or about 250 m2/g. Barton discloses that carbon particles are used to impart good electrical conductivity [0069]. Barton further discloses that the selection of the particular carbon particles (e.g., size and aspect ratio) will influence the level of porosity, coating thickness, and conductivity, as will be appreciated by those skilled in the art. In general, thinner coatings and larger pore sizes will promote mass transport across the coating. The formation of very large pores, however, tends to result in diminished contact between the carbon particles of the microporous layer and active regions of the catalyst, and thus reduces efficiency of a fuel cell for a given loading of carbon particles. Namely, there will be a need to employ routine experimentation to optimize the microporous layer for a particular application. [0083]. The surface area is directly related to particle size and Barton clearly discloses that the particle size is a result effective variable. It has been held by the courts that discovering an optimum value or workable ranges of a result-effective variable involves only routine skill in the art, and thus not novel. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). See MPEP 2144.05. Further, it has been held by the courts that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or

workable ranges by routine experimentation. In re Swain et. al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412.

Barton discloses a controller that regulates the mass flow of methanol and compressed air (reactant gases) [0093]. The functional recitation of the controller has been considered but was not given patentable weight because it has been held by the courts that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (BdPatApp & Inter 1987). See MPEP 2115. The Office notes that the recitation that an element is "configured to" perform a function is not a positive limitation but only requires the ability to so perform. It does not constitute a limitation in any patentable sense.

The microporous layer in the gas diffusion backing so formed has a thickness of about 1 to 100 microns (applicant's claims 10, 11, 30), and a coating weight of a fluorinated polymer of 0.1 to 20 mg/sqcm. In order to be useful in fuel cells, the layer so formed has a network of open micropores providing channels for the passage of water and reactant gases from one side to the other. Typically the micropores will constitute about 50% to about 85% of the layer, by volume, and have a mean pore size in the range of about 0.01 to about 5 microns [0082].

Barton discloses using Toray TGP-H-060. Toray TGP-H-060 has a bulk density of 0.46 g/ml, a gas permeability of 30 mm Aq/mm, and an average thickness of about 180 microns (applicant's claim 17, 33, 42) [0096].

It is evidenced that the mean particle size of carbon Vulcan XC72 is about 30 nm, as evidenced by Yoshida [0131]. (applicant's claims 1, 27, 29).

Claims 14, 18, 19, 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton (US 2003/0157397), as evidenced by Yoshida (US 2003/0091891), as applied to claims 1 and 27, further evidenced by Cipollini (US 6379827).

Barton discloses all the elements of claims 1 and 27 and are incorporated herein. Barton does not disclose the porosity and the mean pore size of the carbon paper (applicant's diffusion media substrate). However, Barton discloses using Toray TGP-H-060. It is evidenced that Toray TGP-H-060 has porosity of about 65-75% (claim 32) and has a mean pore size of about 27 to 37 microns (applicant's claims 18, 19, 34), by Cipollini (5:30-45).

Further, since the pores in the microporous layer has porosity of about 50% to about 85% [Barton, 0082] and the carbon paper Toray TGP-H-060 has a porosity of about 65-75% (Cipolini, 5:30-45), limitation of claim 14 has been met.

Claims 7, 8, 12, 13, 31, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton (US 2003/0157397), as evidenced by Yoshida (US 2003/0091891), as applied to claims 1 and 27 and incorporated herein.

Barton discloses all the elements of claims 1 and 27. Barton does not disclose that the microporous layer comprises greater than 80% of the carbon component. However, Barton discloses that the microporous layer comprises about 1 to 40 wt% carbon particles (applicant's carbon component), 1 to 20 wt% fluorinated polymer, and the balance being the dispersant or a solvent [0080]. Further, Barton discloses that typically, carbon particles are used to impart good electrical conductivity to the second layer (Barton's microporous layer) of the gas diffusion backing [0069]. It is clear that the amount of carbon particles affect the conductivity of the gas diffusion layer and thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the carbon particle amount (applicant's carbon component) proportionally to appropriately control the conductivity (applicant's claims 7, 8, 35). It has been held by the courts that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et. al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412. Further, Barton discloses that carbon particles affect conductivity, thus clearly teaching that the amount of carbon particles is a result effective variable. It has been held by the courts that discovering an optimum value or workable ranges of a result-effective variable involves only routine skill in the art, and thus not novel. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). See MPEP 2144.05.

Barton does not disclose that microporous layer infiltrates into the carbon paper to a depth of less than 5 um or 10 um. However, Barton discloses that the microporous layer will be coated or laminated directly onto the carbonaceous paper, and thus, be in

electrically conductive contact [0055]. Further, since the carbon fibrous paper is porous, the microporous layer must necessarily microscopically infiltrate into the carbonaceous paper. Since Barton discloses that good electrical conductive contact must be present between the microporous layer and the carbon paper, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary and adjust the amount of infiltration for the benefit of attaining good adhesion between the two layers (applicant's claims 12, 13, 31).

Claims 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton (US 2003/0157397), as evidenced by Yoshida (US 2003/0091891), as applied to claim 1 and incorporated herein, in view of Larson (US 2003/0134178).

Barton discloses all the elements of claim 1. Barton discloses that the mean particle size of carbon Vulcan XC72 is about 30 nm, as evidenced by Yoshida [0131], but Barton does not disclose that the mean particle size is of about 42 (claim 4) nm. However, Larson teaches that carbon particles can be used for diffusion layer with typically having an average particle size of 1-100 nm [0027]. Larson teaches that the gas diffusion membrane must be conductive yet must be able to allow the passage of reactant and product fluids [0019]. Further, the particle size correlates with surface area, and thus the available reactive area. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the carbon particle size for the benefit of easily mixing the microporous layer mixture and ultimately

adjusting the particle size to control the fluid passage and reactive surface area. It is clear that the mean particle size is a result effective variable. It has been held by the courts that discovering an optimum value or workable ranges of a result-effective variable involves only routine skill in the art, and thus not novel. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). See MPEP 2144.05.

The fluorinated polymer comprises poly(vinylidene fluoride) and PTFE [0060]. Carbon particles can be of any form that include, but not limited to Vulcan ®, SP Carbon & Ensaco, and Applied Science Graphite Fibers. Although Barton does not expressly disclose a hydrophilic carbonaceous component comprising acetylene black, acetylene black is commonly used as a conducting agent in the fuel cell art, as shown by Larsen [0027]. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute acetylene black for graphite in the microporous layer (applicant's claim 6).

Claims 16 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton (US 2003/0157397), as evidenced by Yoshida (US 2003/0091891) as applied to claim 1, in view of Zuber (US 2002/0041992).

Barton discloses all the elements of claim 1 and are incorporated herein. Barton discloses that the porosity of the carbon paper is between 65-75%, as evidenced by Cipollini, but does not disclose that the porosity is above about 80%. However, Zuber teaches that the carbon substrate of the gas diffusion structure is preferably formed by a

carbon fiber substrate with a porosity raging between 60 and 90% [0022]. Further, Zuber teaches that the gas diffusion structure facilitates good access by the reaction gases to the electrodes and efficient conduction of the cell current are applied to the electrodes [0004]. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to increase the porosity of the diffusion substrate for the benefit of enhancing good diffusion of the reactant gases.

Claims 36-40, 44, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton (US 2003/0157397), as evidenced by Yoshida (US 2003/0091891), in view of Larson (US 2003/0134178).

Barton discloses a fuel cell comprising a cathode gas and an anode gas. The fuel cell comprises a gas diffusion backing layer on a catalyst coated membrane. The reactant gases traverse through the gas diffusion backing layer, and thus are humidified. The gas diffusion backing comprises a porous carbonaceous paper having randomly oriented fibrils. The gas diffusion backing further comprises a microporous layer adjacent the porous carbonaceous paper. The microporous layer consists essentially of a fluorinated polymer that contains carbon particles [0050, 0055]. The carbon particles can comprise graphite fibers [0069]. The fluorinated polymer comprises poly(vinylidene fluoride) and PTFE [0060]. Carbon particles can be of any form that include, but not limited to Vulcan ® XC72, SP Carbon & Ensaco, and Applied Science Graphite Fibers with an average surface area of about 50 to 800 m2/g [0069].

Although Barton discloses an average surface area of about 50 to 800 m2/g [0069], Barton does not disclose that the surface area is above 750 m2/g (applicant's claim 36). Barton discloses that carbon particles are used to impart good electrical conductivity [0069]. Barton further discloses that the selection of the particular carbon particles (e.g., size and aspect ratio) will influence the level of porosity, coating thickness, and conductivity, as will be appreciated by those skilled in the art. In general, thinner coatings and larger pore sizes will promote mass transport across the coating. The formation of very large pores, however, tends to result in diminished contact between the carbon particles of the microporous layer and active regions of the catalyst, and thus reduces efficiency of a fuel cell for a given loading of carbon particles. Namely, there will be a need to employ routine experimentation to optimize the microporous layer for a particular application. [0083]. The surface area is directly related to particle size and Barton clearly discloses that the particle size is a result effective variable. It has been held by the courts that discovering an optimum value or workable ranges of a result-effective variable involves only routine skill in the art, and thus not novel. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). See MPEP 2144.05. Further, it has been held by the courts that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et. al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412.

Barton discloses that the mean particle size of carbon Vulcan XC70 is about 30 nm, as evidenced by Yoshida [0131], but Barton does not disclose that the mean

particle size is less than about 20 (claim 36). However, Larson teaches that carbon particles can be used for diffusion layer with typically having an average particle size of 1-100 nm [0027]. Larson teaches that the gas diffusion membrane must be conductive yet must be able to allow the passage of reactant and product fluids [0019]. Further, the particle size correlates with surface area, and thus reactive sites, as disclosed by Barton [0083]. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the carbon particle size for the benefit of easily mixing the microporous layer mixture and ultimately adjusting the particle size to control fluid passage and the reactive surface area as appropriate. Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the particle size less than 20 nm for the benefit of tightly packing the carbon particles.

Barton discloses a controller that regulates the mass flow of methanol and compressed air (reactant gases) [0093]. The functional recitation of the controller has been considered but was not given patentable weight because it has been held by the courts that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (BdPatApp & Inter 1987). See MPEP 2115. The Office notes that the recitation that an element is "configured to" perform a function is not a positive limitation but only requires the ability to so perform. It does not constitute a limitation in any patentable sense.

Barton does not disclose that the microporous layer comprises greater than 80% of the carbon component. However, Barton discloses that the microporous layer comprises about 1 to 40 wt% carbon particles (applicant's carbon component), 1 to 20 wt% fluorinated polymer, and the balance being the dispersant or a solvent [0080]. Further, Barton discloses that typically, carbon particles are used to impart good electrical conductivity to the second layer (Barton's microporous layer) of the gas diffusion backing [0069]. It is clear that the amount of carbon particles affect the conductivity of the gas diffusion layer and thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the carbon particle amount (applicant's carbon component) proportionally to appropriately control the conductivity (applicant's claims 44, 45). It has been held by the courts that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et. al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412.

Barton does not disclose that microporous layer infiltrates into the carbon paper to a depth of less than 5 um or 10 um. However, Barton discloses that the microporous layer will be coated or laminated directly onto the carbonaceous paper, and thus, be in electrically conductive contact [0055]. Further, since the carbon fibrous paper is porous, the microporous layer must necessarily microscopically infiltrate into the carbonaceous paper. Since Barton discloses that good electrical conductive contact must be present between the microporous layer and the carbon paper, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary and adjust the

amount of infiltration for the benefit of attaining good adhesion between the two layers (applicant's claims 39, 40).

The microporous layer in the gas diffusion backing so formed has a thickness of about 1 to 100 microns (applicant's claims 38), and a coating weight of a fluorinated polymer of 0.1 to 20 mg/sqcm. In order to be useful in fuel cells, the layer so formed has a network of open micropores providing channels for the passage of water and reactant gases from one side to the other. Typically the micropores will constitute about 50% to about 85% of the layer, by volume, and have a mean pore size in the range of about 0.01 to about 5 microns [0082].

Claims 41-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton (US 2003/0157397), as evidenced by Yoshida (US 2003/0091891), in view of Larson (US 2003/0134178) as applied to claim 36, further evidenced by Cipollini (US 6379827).

Barton and Larson disclose all the elements of claim 36. Barton discloses using Toray TGP-H-060. It is evidenced that Toray TGP-H-060 has porosity of about 65-75% and has a mean pore size of about 27 to 37 microns (applicant's claims 41 and 43), by Cipollini (5:30-45). Toray TGP-H-060 has a bulk density of 0.46 g/ml, a gas permeability of 30 mm Aq/mm, and an average thickness of about 180 microns (applicant's claim 42) [Barton, 0096].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cynthia Lee whose telephone number is 571-272-8699. The examiner can normally be reached on Monday-Friday 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PATRICK JOSEPH RYAN
SUPERVISORY PATENT EXAMINER

ckl

Cynthia Lee

Patent Examiner